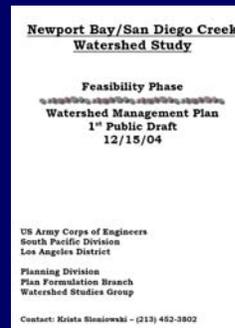




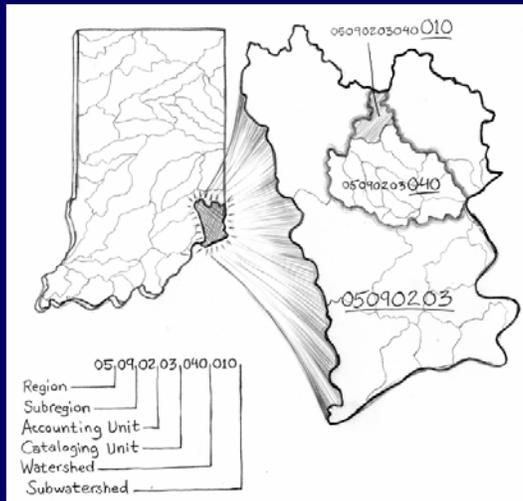
## Contents of a Watershed Plan

- Introduction
  - ◆ Plan area & description, partners, background
- Water quality information & analysis
  - ◆ WQS & goals, monitoring/assessment results
  - ◆ Key pollutants / stressors, sources, current loads
- Proposed management measures
  - ◆ Load reductions needed, BMP types proposed
  - ◆ Reductions expected from BMPs, installation sites
- Implementation plan
  - ◆ Public info/education & outreach/involvement plan
  - ◆ BMP/\$\$/TA support sources, project schedule & costs
- Monitoring and adaptive management approach
  - ◆ Interim measurable milestones, load reduction criteria
  - ◆ Evaluation framework, monitoring plan & partners



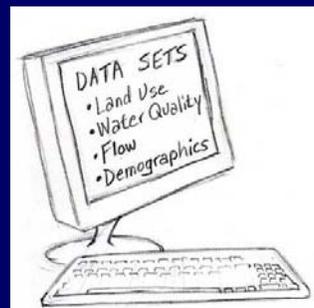
## Introduction

- Geographic area
  - ◆ Basis for selection
- Watershed inventory
  - ◆ Physical description
  - ◆ Climate
  - ◆ Geology
  - ◆ Hydrology
  - ◆ Soils
  - ◆ Biota
  - ◆ Land cover & uses
  - ◆ Resources & recreation
  - ◆ Programmatic infrastructure
  - ◆ Economic, social, cultural and historic background
- Partners



## Water quality info & analysis

- Water quality goals
  - ◆ Designated uses, WQ criteria
  - ◆ Restoration and protection goals
  - ◆ Flooding, aesthetics, others???
- Monitoring and assessment results
  - ◆ Desktop data mining, local monitoring results
  - ◆ ID impaired & threatened waters
  - ◆ CWA 106 program data
- Key pollutants / stressors
  - ◆ Check 303(d); local monitoring/assessment
- Pollutant sources
  - ◆ From 303(d) or other assessment
- Current pollutant estimates
  - ◆ Estimate, model, or otherwise describe



# Types of Data for Watershed Characterization

- **Physical and Natural Features**
  - ◆ Watershed boundaries
  - ◆ Hydrology
  - ◆ Topography
  - ◆ Soils
  - ◆ Climate
  - ◆ Habitat
  - ◆ Wildlife
- **Land Use and Population Characteristics**
  - ◆ Land use and land cover
  - ◆ Existing management practices
  - ◆ Demographics
- **Waterbody Conditions**
  - ◆ Water quality standards
  - ◆ 305(b) report
  - ◆ 303(d) list
  - ◆ TMDL reports
  - ◆ Source Water Protection Areas
- **Pollutant Sources**
  - ◆ Point sources
  - ◆ Nonpoint sources
- **Waterbody Monitoring Data**
  - ◆ Water quality data
  - ◆ Flow data
  - ◆ Biological data

<http://www.epa.gov/tribalcompliance/index.html>



California Watershed Portal

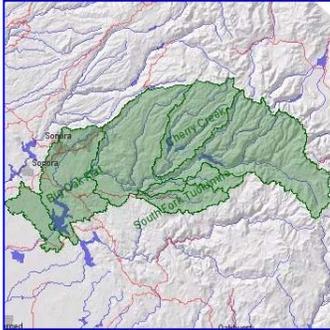
Search For:

Watershed Search Tools

search by name

View Mode:  Image  Map  Shade

California Watersheds

Location	TUOLUMNE RIVER (hu)	Subregions
 San Joaquin (tr)		<a href="#">Big Oak Flat (ha)</a> <a href="#">Cherry Creek (ha)</a> <a href="#">Clavey River (ha)</a> <a href="#">Hetch Hetchy (ha)</a> <a href="#">Middle Tuolumne (ha)</a> <a href="#">South Fork Tuolumne (ha)</a> <a href="#">Tuolumne (ha)</a> <a href="#">Vizard Creek (ha)</a>

Zoom Views: [Medium Image \(600 x 600\)](#) [Large Image \(1600 x 1600\)](#)

Data for this Region

[Catalog \(CEC\)](#)  
 [Imagery \(CaSIL\)](#)  
 [Rare Species \(CHDD8\)](#)  
 [Projects \(NRP1\)](#)

Results from

The following CEC geographic place names spatially intersect with the watershed **TUOLUMNE RIVER (hu)**. Click on a place name to link to view the entries. Project information provided by the Resources Agency CERES Program.

CALFISH

A CALIFORNIA COOPERATIVE FISH AND HABITAT DATA PROGRAM

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<http://www.calfish.org>

**Two-Fold Mission:**

To create, maintain, and enhance high quality, consistent data that are directly applicable to policy, planning, management, research, and recovery of anadromous fish and related aquatic resources in California; and

To provide data and information services in a timely manner in formats that meet the needs of users.



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**USGS**  
science for a changing world

Water Resources National Water Information System: Web Interface

Data Category: Real-time Geographic Area: California GO

### USGS Real-Time Water Data for California

--- Predefined displays --- Group table by Select sites by number or name  
 Introduction - no grouping - [input field] GO

#### Daily Streamflow Conditions

Select a site to retrieve data and station information.  
 Monday, January 15, 2007 10:06ET

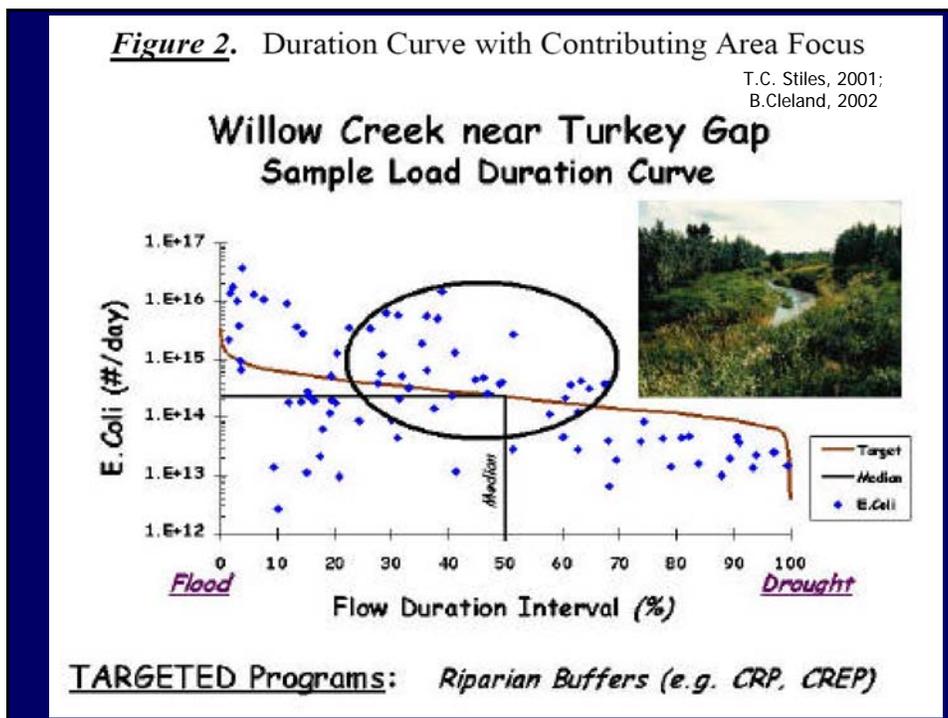
#### Statewide Streamflow Table

Real-time data typically are recorded at 15-60 minute intervals, stored onsite, and then transmitted to USGS offices every 1 to 4 hours, depending on the data relay technique used. Recording and transmission times may be more frequent during critical events. Data from real-time sites are relayed to USGS offices via satellite, telephone, and/or radio and are available for viewing within minutes of arrival.

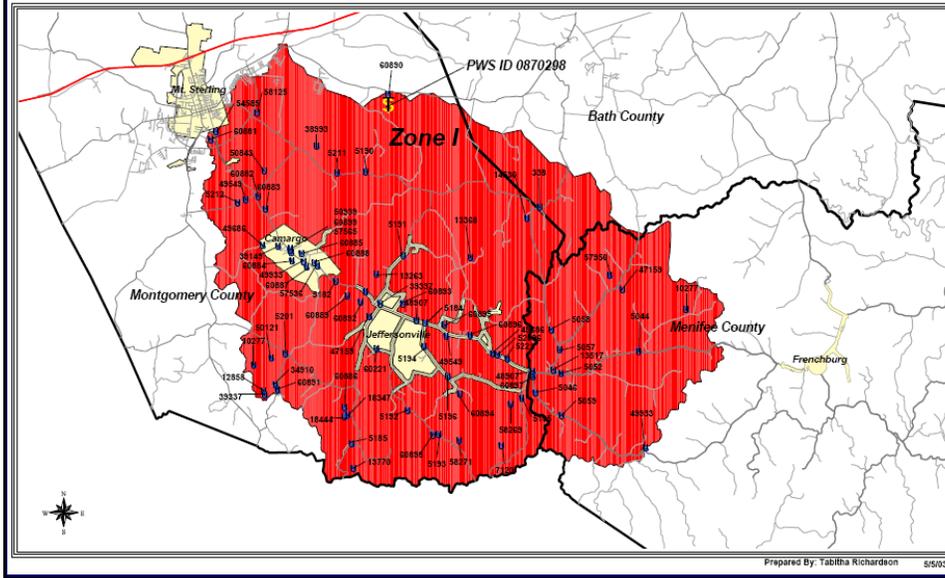
All real-time data are [provisional and subject to revision](#).

[Build Table](#) Build a custom summary table for one or more stations.  
[Build Sequence](#) Build a custom sequence of graphical or tabular data for one or more stations.

Flow data is available from the US Geological Survey web site at <http://waterdata.usgs.gov/nwis/rt>



# Source Water Protection Map



**List of Contaminant Sources with Susceptibility Rating**  
PWS ID: 0870298 System Name: MT STERLING WATER WORKS  
Withdrawal ID Type: Water Withdrawal ID (Surface Water)

**Withdrawal Source Information:**  
Withdrawal ID: 0191 Latitude: 38.05972 Longitude: -83.8475  
Status: Active Area Dev. District: Gateway Area Development District Collection Method: INT  
County: MONTGOMERY

**Comments:** This withdrawal source is located in a small reservoir.

**Contaminant Source Information:**

ID	Category	Name	Address	Proximity	Contaminant	Likelihood of	Hydrologic	Numerical	Susceptibility		
17928	Landfill - Inactive	FOOTHILLS SANITARY LANDFILL, INC.	Mailing/Site Address: EFFEYSONVILLE, KY 40337, County Name: Montgomery	1	1	3	3	4	18	High	
18444	Landfill Sites - historical, needs attention	Mt. Sterling Landfill	County Name: Montgomery	1	1	3	3	4	18	High	
37871	Railroads	Statewide Railroad Coverage for Kentucky	The whole Kentucky state	1	1	3	3	4	18	High	
60410	Row Crops (Land Cover)	Statewide Coverage of Row Crops (Land Cover) for Kentucky	The whole Kentucky state	1	1	3	3	4	18	High	
38993	Superfund Sites - Active	COLUMBIA GULF - 801810	Mailing/Site Address: HWY713, MEANS, KY, County Name: MENIFEE	1	1	3	3	4	18	High	
39337	Superfund Sites - Active	DONALDSON DUMP	County Name: MONTGOMERY	1	1	3	3	4	18	High	
39149	Superfund Sites - Active	TEXAS EASTERN	County Name: MONTGOMERY	1	1	3	3	4	18	High	
11395	Tier II: Hazardous Chemical Use	A.O. SMITH ELECT. PRODUCTS CO.	Address: 2001 OWINGSVILLE ROAD, MT STERLING, KY 40333, County Name: MONTGOMERY	1	1	3	3	4	18	High	
10277	Tier II: Hazardous Chemical Use	RUMPKER OF KENTUCKY, INC.	Address: DEB MT STERLING LANDFILL, 30 DUMP RD., JEFFERSONVILLE, KY 40337, County	1	1	3	3	4	18	High	
13517	KPDDES Permit - Municipal, Industrial and Oil Lease	MENIFEE CO SD #1 CO LINE		1	1	3	3	2	4	17	High
13263	KPDDES Permit - Municipal, Industrial and Oil Lease	MONTGOMERY CO SANIT DIST #2		1	1	3	3	2	4	17	High
13770	KPDDES Permit - Municipal, Industrial and Oil Lease	THE WALKER CO OF KY INC POWELL		1	1	3	3	2	4	17	High
13368	KPDDES Permit - Municipal, Industrial and Oil Lease	TN GAS PIPELINE COMP STAT 107		1	1	3	3	2	4	17	High
18347	Landfill Sites - historical, cleaned or covered	Henry L. Profit Sanitation	County Name: Montgomery	1	1	3	3	2	4	17	High
47159	UTC Class 1, 2, and 5-7	CHARMINE OIL	Mailing/Site Address: P.O. BOX 1280, BEATTYVILLE, KY 41311, Phone: 6064642960, Contact: ROBERT	1	1	3	3	2	4	17	High

## Sample Data Sources

- Watershed Coverages:
  - ◆ 8 digit: <http://water.usgs.gov/GIS/huc.html>
  - ◆ 14 digit: [www.ncgc.nrcs.usda.gov/products/datasets/watershed](http://www.ncgc.nrcs.usda.gov/products/datasets/watershed)
  - ◆ EPA Reach Files - 3 versions RF1, RF2, RF3 Alpha (most detailed)
  - ◆ [www.epa.gov/waterscience/ftp/basins/gis\\_data/huc/](http://www.epa.gov/waterscience/ftp/basins/gis_data/huc/)
- Elevation Data
  - ◆ USGS: <http://edc.usgs.gov/geodata>
  - ◆ GIS data depot: <http://data.geocomm.com>
- Land Use/Population
  - ◆ USGS: <http://edc.usgs.gov/geodata>
  - ◆ EPA: [www.epa.gov/nrlc/nlcd.html](http://www.epa.gov/nrlc/nlcd.html)
- BLM Management Plans
  - ◆ [www.blm.gov/planning/plans.html](http://www.blm.gov/planning/plans.html)



## Other Data Sources

- State 303 (d) lists and TMDL reports
  - ◆ [www.epa.gov/owow/tmdl](http://www.epa.gov/owow/tmdl)
- Point source discharge permits
  - ◆ [www.epa.gov/enviro/html/pes/index.html](http://www.epa.gov/enviro/html/pes/index.html)
- Agricultural Statistics
  - ◆ <http://www.nass.usda.gov/index.asp>
- Septic tank use
  - ◆ <http://quickfacts.census.gov/>



## Identifying stressors and sources

- Identify water quality goals and existing impairments or threats
  - ◆ Examples: metals / acidity from X number of abandoned mine lands, sediment & high flows from urban runoff, sediment from construction sites, habitat loss from channelization, etc.
- Estimate pollutant sources requiring controls
  - ◆ Examples: # of miles of pasture streams needing fencing; number of mine sites needing treatment with estimates and general profiles of flows, etc.
  - ◆ Can “bundle” stressors and/or sources
    - ◆ All pasture cattle operations, all development sites
    - ◆ All sources of sediment, all sources of phosphorus



<u>Cause/Stressor Category</u>	<u>Impacted Miles</u>
Siltation .....	1,753.2
Pathogens .....	1,348.1
Other Habitat Alterations .....	1,023.1
PCBs .....	805.5
Organic Enrichment/Low DO .....	570.2
Nutrients .....	540.1
Salinity/TDS/Chlorides .....	499.9
Causes Unknown .....	463.9
Metals .....	362.5
Flow Alteration .....	337.8
Sulfates .....	240.7
pH .....	229.7
Dioxins .....	194.4
Turbidity .....	141.0
Algal Growth/Chlorophyll <i>a</i> .....	55.1
Suspended Solids .....	52.8
Unionized Ammonia .....	39.5
Thermal Modifications .....	33.1
Unknown Toxicity .....	19.3
Priority Organics .....	18.0
Noxious Aquatic Weeds .....	13.8
Radiation .....	13.0
Chlorine .....	12.2
Oil and Grease .....	11.5
Other Inorganics .....	11.5
Exotic Species .....	8.4
Pesticides .....	5.3
Nonpriority Organics .....	5.2
Taste and Odor .....	1.9

## Stressors

# Sources

Source Category	Miles Impacted
Source Unknown	1,631
Agriculture	1,477.2
Crop-related Sources	634.1
Nonirrigated Crop Production	424.4
Irrigated Crop Production	84.4
Specialty Crop Production	3.6
Grazing related Sources	620.8
Pasture grazing - Riparian and/or Upland	222.9
Pasture grazing - Upland	19.6
Range grazing - Riparian and/or Upland	0.7
Intensive Animal Feeding Operations	105.6
Concentrated Animal Feeding Operations (permitted, point source)	22.3
Confined Animal Feeding Operations (NPS)	49.4
Habitat Modification (other than Hydromodification)	1059.2
Removal of Riparian Vegetation	717.7
Bank or Shoreline Modification/Destabilization	265.6
Drainage/Filling of Wetlands	10.7
Resource Extraction	924.7
Surface Mining	525.4
Subsurface Mining	222.8
Dredge Mining	25.6
Petroleum Activities	190.6
Mine Tailings	6.9
Acid Mine Drainage	114.5
Abandoned Mining	91
Inactive Mining	104.1
Urban Runoff/Storm Sewers	721.3
Erosion and Sedimentation	267.3
Non-industrial Permitted	4.3
Industrial Permitted	15.8
Other Urban Runoff	178.3
Illicit Connections/Illegal Hook-ups/Dry Weather Flows	10.6
Hydromodification	527.1
Channelization	403.2
Dredging	92.4
Dam Construction	3.2
Upstream Impoundment	35.1
Flow Regulation/Modification	32.1
Silviculture	254.4
Harvesting, Restoration, Residue Management	156.8
Logging Road Construction/Maintenance	10.5
Silvicultural Point Sources	3.5

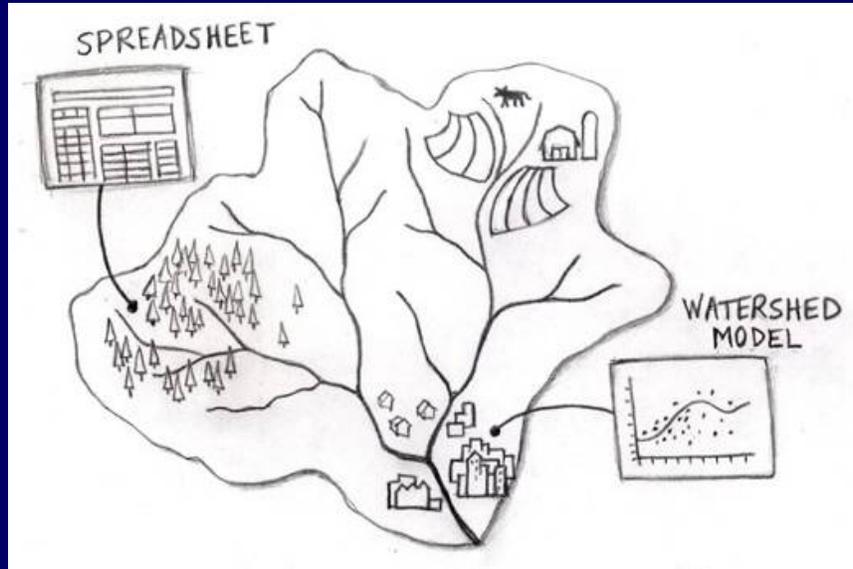


## Supplementing available data

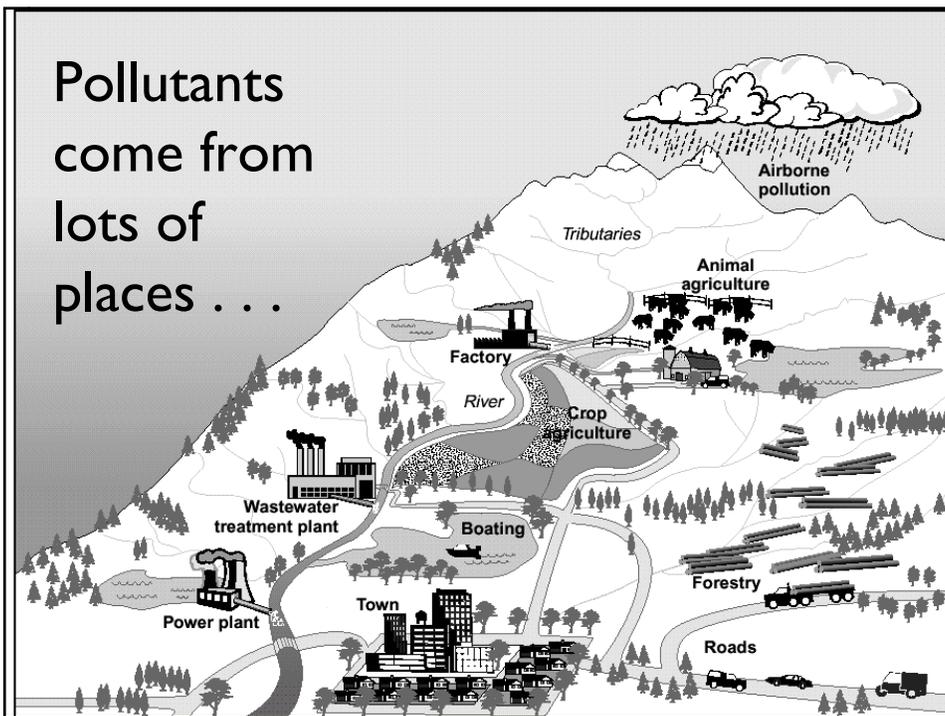
- ◆ Windshield surveys
- ◆ Interviews with residents
- ◆ Volunteer monitoring
- ◆ Bioassessment
- ◆ Targeted sampling
- ◆ Chemical/biological sampling

*Helps lay the groundwork for implementation!*

## How can we identify pollutant sources?



Pollutants  
come from  
lots of  
places . . .



## Pollutants come from:

- Point-source discharges (NPDES facilities)
  - ◆ Info is available on the discharges (DMRs, etc.)
  - ◆ Some are steady-flow, others are precip-driven
- Nonpoint sources (polluted runoff)
  - ◆ All are (mostly) precip-driven
  - ◆ Identifying & prioritizing sources is tough
  - ◆ Literature values can be used to estimate
  - ◆ Modeling gets you closer . . . . do you need it?
- Air / atmospheric deposition
  - ◆ Can be significant in some locations

**Table 2-2. Summary of Common Pollutants and Sources**

Pollutant	Potential Sources		Impacts on Waterbody Uses
	Point Sources	Nonpoint Sources	
Pathogens	<ul style="list-style-type: none"> <li>• WWTPs</li> <li>• CSOs/SSOs</li> <li>• Permitted CAFOs</li> <li>• Discharges from meat processing facilities</li> <li>• Landfills</li> </ul>	<ul style="list-style-type: none"> <li>• Animals (domestic, wildlife, livestock)</li> <li>• Malfunctioning septic systems</li> <li>• Pastures</li> <li>• Boat pumpout facilities</li> <li>• Land application of manure</li> <li>• Land application of wastewater</li> </ul>	<ul style="list-style-type: none"> <li>• Primarily human health risks</li> <li>• Risk of illness from ingestion or from contact with contaminated water through recreation</li> <li>• Increased cost of treatment of drinking water supplies</li> <li>• Shellfish bed closures</li> </ul>
Metals	<ul style="list-style-type: none"> <li>• Urban runoff</li> <li>• WWTPs</li> <li>• CSO/SSOs</li> <li>• Landfills</li> <li>• Industrial facilities</li> <li>• Mine discharges</li> </ul>	<ul style="list-style-type: none"> <li>• Abandoned mine drainage</li> <li>• Hazardous waste sites (unknown or partially treated sources)</li> <li>• Marinas</li> </ul>	<ul style="list-style-type: none"> <li>• Aquatic life impairments (e.g., reduced fish populations due to acute/chronic concentrations or contaminated sediment)</li> <li>• Drinking water supplies (elevated concentrations in source water)</li> <li>• Fish contamination (e.g., mercury)</li> </ul>
Nutrients	<ul style="list-style-type: none"> <li>• WWTPs</li> <li>• CSOs/SSOs</li> <li>• CAFOs</li> <li>• Discharge from food- processing facilities</li> <li>• Landfills</li> </ul>	<ul style="list-style-type: none"> <li>• Cropland (fertilizer application)</li> <li>• Landscaped spaces in developed areas (e.g., lawns, golf courses)</li> <li>• Animals (domestic, wildlife, livestock)</li> <li>• Malfunctioning septic systems</li> <li>• Pastures</li> <li>• Boat pumpout</li> <li>• Land application of manure or wastewater</li> </ul>	<ul style="list-style-type: none"> <li>• Aquatic life impairments (e.g., effects from excess plant growth, low DO)</li> <li>• Direct drinking water supply impacts (e.g., dangers to human health from high levels of nitrates)</li> <li>• Indirect drinking water supply impacts (e.g., effects from excess plant growth clogging drinking water facility filters)</li> <li>• Recreational impacts (indirect impacts from excess plant growth on fisheries, boat/swimming access, appearance, and odors)</li> <li>• Human health impacts</li> </ul>

Pollutant	Potential Sources		Impacts on Waterbody Uses
	Point Sources	Nonpoint Sources	
Sediment	<ul style="list-style-type: none"> <li>• WWTPs</li> <li>• Urban stormwater systems</li> </ul>	<ul style="list-style-type: none"> <li>• Agriculture (cropland and pastureland erosion)</li> <li>• Silviculture and timber harvesting</li> <li>• Rangeland erosion</li> <li>• Excessive streambank erosion</li> <li>• Construction</li> <li>• Roads</li> <li>• Urban runoff</li> <li>• Landslides</li> <li>• Abandoned mine drainage</li> <li>• Stream channel modification</li> </ul>	<ul style="list-style-type: none"> <li>• Fills pools used for refuge and rearing</li> <li>• Fills interstitial spaces between gravel (reduces spawning habitat by trapping emerging fish and reducing oxygen exchange)</li> <li>• When suspended, prevents fish from seeing food and can clog gills; high levels of suspended sediment can cause fish to avoid the stream</li> <li>• Taste/odor problems in drinking water</li> <li>• Impairs swimming/boating because of physical alteration of the channel</li> <li>• Indirect impacts on recreational fishing</li> </ul>
Temperature	<ul style="list-style-type: none"> <li>• WWTPs</li> <li>• Cooling water discharges (power plants and other industrial sources)</li> <li>• Urban stormwater systems</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of riparian shading</li> <li>• Shallow or wide channels (due to hydrologic modification)</li> <li>• Hydroelectric dams</li> <li>• Urban runoff (warmer runoff from impervious surfaces)</li> <li>• Sediment (cloudy water absorbs more heat than clear water)</li> <li>• Abandoned mine drainage</li> </ul>	<ul style="list-style-type: none"> <li>• Causes lethal effects when temperature exceeds tolerance limit</li> <li>• Increases metabolism (results in higher oxygen demand for aquatic organisms)</li> <li>• Increases food requirements</li> <li>• Decreases growth rates and DO</li> <li>• Influences timing of migration</li> <li>• Increases sensitivity to disease</li> <li>• Increases rates of photosynthesis (increases algal growth, depletes oxygen through plant decomposition)</li> <li>• Causes excess plant growth</li> </ul>

Note: WWTP = wastewater treatment plant; CSO = combined sewer overflow; SSO = sanitary sewer overflow; CAFO = concentrated animal feeding operation; DO = dissolved oxygen.





Table 9. Unit loads of pollutants (kg/ha/yr) from different land uses \*

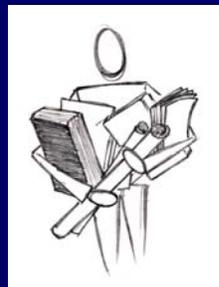
Pollutant	Central business district	Other commercial	Industrial	Single family res.	Multi-family res.	Cropland	Pasture	Forest	Open
TSS	1080	840	56	17	440	450	340	85	7
COD	1070	1020	63	28	330	n.a.	n.a.	n.a.	2.0
Pb	7.1	3.0	2.0 - 7.1	0.1	0.7	0.005 - 0.006	0.003 - 0.015	0.01 - 0.03	n.a.
Zn	3.0	3.3	3.5 - 12	0.22	0.33	0.03 - 0.08	0.02 - 0.17	0.01 - 0.03	n.a.
Cu	2.1	n.a.	0.33 - 1.1	0.03	0.33	0.01 - 0.06	0.02 - 0.04	0.02 - 0.03	n.a.
NO <sub>3</sub> +NO <sub>2</sub> -N	4.5	0.67	0.45	0.33	3.8	7.9	0.33	0.56	0.33
TKN	15	15	2.2 - 15	1.1 - 5.6	3.4 - 4.5	1.7	0.67	2.9	1.7
TP	2.8	2.7	0.9 - 4.0	0.2 - 1.5	1.3 - 1.6	0.1 - 3.0	0.07 - 3.0	0.02 - 0.45	0.06

\* Exact values are given where available; otherwise ranges are reported.

Adapted from Horner et al. (1986)

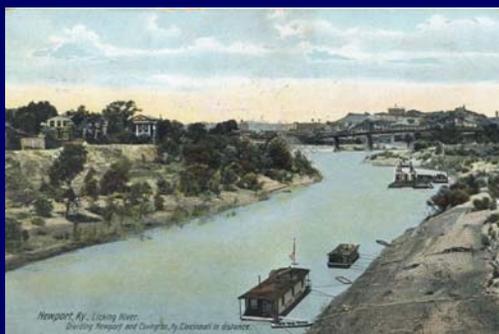
## Identification of causes & sources

- What “pollutants” are you dealing with?
  - ◆ Chemical or other stressors or causes of impairment
- How big is the problem for each?
- How do you know?
  - ◆ Did you measure or prioritize them?
  - ◆ Did you estimate? How?
- Where are they coming from?
  - ◆ Can you put the info on a map?
- Can you estimate the % from each source?



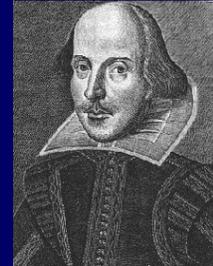
## Reducing pollutants: the basics

- Simple (linear) approach
  - ◆ Use observed data
  - ◆ Empirical relationships
  - ◆ Reduce the concentration
  - ◆ Reduce the source area
  - ◆ Reduce # of sources
- Complex (modeled) approach
  - ◆ Model the pollutants
  - ◆ Model BMP reductions
  - ◆ Layers can include topography, soils, climate, land use, land cover, pollutant transport/fate, point sources, management practices, etc.



# To model, or not to model . . .

- As these things increase:
  - ◆ Number of pollutants
  - ◆ Complexity of loads/stressors
  - ◆ Uncertainty regarding existing information
  - ◆ Expense involved in addressing problems
- The need for more sophisticated modeling also increases



http://www.stormwatercenter.net/monitoring%20and%20assessment/wtm(3-1).xls - Microsoft Internet Explorer provided by Tetra Tech

Address: http://www.stormwatercenter.net/monitoring%20and%20assessment/wtm(3-1).xls

Back Forward Stop Refresh Home Search Favorites 11 blocked AutoCheck AutoFill Options

P55

PRIMARY SOURCES - Land Use		Area (Acres)	TSS lb/acre	FC # billion/acre	TN lb/year	Annual Load TP lb/year	TSS lb/year	FC # billion/year
Residential	LDR (<1 du/acre)	90	12	-	-	-	-	-
	MDR (1-4 du/acre)	90	12	-	-	-	-	-
	HDR (>4 du/acre)	90	12	-	-	-	-	-
	Multi-family	30	12	-	-	-	-	-
		90	12	-	-	-	-	-
		90	12	-	-	-	-	-
		90	12	-	-	-	-	-
		90	12	-	-	-	-	-
Commercial		0	-	-	-	-	-	-
		0	-	-	-	-	-	-
		0	-	-	-	-	-	-
		0	-	-	-	-	-	-
Roadway		0	-	-	-	-	-	-
		0	-	-	-	-	-	-
		0	-	-	-	-	-	-
		0	-	-	-	-	-	-
Industrial		0	-	-	-	-	-	-
		0	-	-	-	-	-	-
		0	-	-	-	-	-	-
		0	-	-	-	-	-	-
Forest		100	12	-	-	-	-	-

Primary Sources / Secondary Sources / Existing Management Practices / Future Manage

Unknown Zone

start | My webs... | WBP Lo... | agends... | Inbox... | http://... | The Pro... | Overview... | Desktop | 3:38 PM

**U.S. Environmental Protection Agency**

## STEPL - Spreadsheet Tool for Estimating Pollutant Load

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**Welcome to STEPL** <http://it.tetrattech-ffx.com/stepl>



Spreadsheet Tool for Estimating Pollutant Load (STEPL) employs simple algorithms to calculate nutrient and sediment loads from different land uses and the load reductions that would result from the implementation of various best management practices (BMPs). STEPL provides a user-friendly Visual Basic (VB) interface to create a customized spreadsheet-based model in Microsoft (MS) Excel. It computes watershed surface runoff, nutrient loads, including nitrogen, phosphorus, and 5-day biological oxygen demand (BOD5), and sediment delivery based on various land uses and management practices. For each watershed, the annual nutrient loading is calculated based on the runoff volume and the pollutant concentrations in the runoff water as influenced by factors such as the land use distribution and management practices. The annual sediment load (sheet and rill erosion only) is calculated based on the Universal Soil Loss Equation (USLE) and the sediment delivery ratio. The sediment and pollutant load reductions that result from the implementation of BMPs are computed using the known BMP efficiencies.

Region 5 model is an Excel workbook that provides a gross estimate of sediment and nutrient load reductions from the implementation of agricultural and urban BMPs. The algorithms for non-urban BMPs are based on the "Pollutants controlled: Calculation and documentation for Section 319 watersheds training manual" (Michigan Department of Environmental Quality, June 1999). The algorithms for urban BMPs are based on the data and calculations developed by Illinois EPA. Region 5 model does not estimate pollutant load reductions for dissolved constituents.



**Questions? Please contact:**  
[STEPL E-mail support](#)  
 Telephone support (EPA and EPA clients only): (703)385-6000 (Ting Dai or Henry Manguerra)  
 Developed for [EPA Office of Water](#)  
 Grants Reporting and Tracking System  
 By [Tetra Tech, Inc.](#)  
 Last revised: 7/3/2003

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STEPL Model Input Data Server - Microsoft Internet Explorer provided by Bellsouth

Address: <http://hudson.tetrattech-ffx.com/website/stepl/viewer.htm>

### STEPL Model Input Data Server

**Step 1: Select a state**

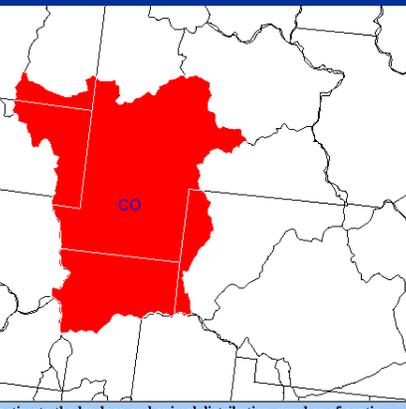
- Colorado
- Connecticut
- District of Columbia
- Delaware
- Florida
- Georgia

**Step 2: Select a county**

- Adams
- Alermosa
- Archuleta
- Baca
- Bent

Or select a HUC

- 14010003 : Eagle
- 14010004 : Roaring Fork
- 14010005 : Colorado headwat
- 14010006 : Parachute-Roen
- 14020001 : East-Taylor
- 14020002 : Upper Gunnison



This tool can be used to estimate the landuse and animal distribution, number of septic system and failure rate, and hydrologic group for your area of interest. These information are required input for the STEPL model. The data are provided by HUCO (overlay of county and 8-digit hydrologic unit boundary).

**Step 3: Activate the**  
 Select tool  and click on the map to refine the area of interest

**Step 4: Select report**

**Basic**  
 Generates a preformatted report with tables that you can paste directly into the STEPL worksheets

**Custom**  
 Generates preformatted reports using custom percentages of HUC surface area

Map: -922610.47, 1678909.67 -- Image: 436, 420 -- ScaleFactor: 383.7641843971691

Slide 8 of 111    Fireball    99%    2:53 PM

### 3. Septic system data

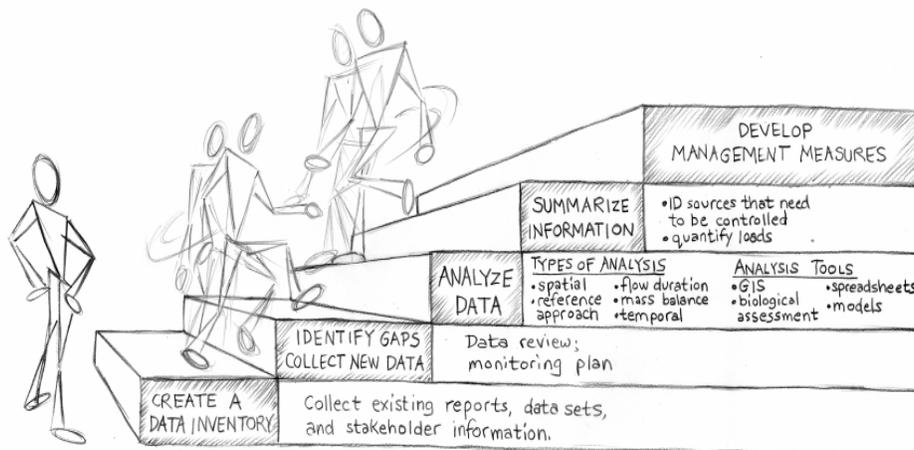
Polygon ID	No. of Septic Systems	Population per Septic System	Septic Failure Rate, %
9657	487	2.08	0.88
9682	1034	1.41	0.88
9805	571	2.36	0.88
10226	42	2.00	0.88
10249	0	1.52	0.88
10339	0	1.52	0.88
10407	0	1.52	0.88
10439	3	1.52	0.88
10526	332	0.37	0.88
10616	1	1.52	0.88
10697	0	1.52	0.88
10704	0	1.52	0.88
10732	0	1.55	0.88
10765	0	1.55	0.88
10808	0	0.46	0.88
10816	0	0.46	0.88
10819	0	0.46	0.88
10847	0	0.46	0.88
Total	2470	1.63	0.88

Source: National Environmental Service Center: 1992 and 1998 summary of the status of onsite wastewater treatment systems in the United States

### 4. Hydrological Group

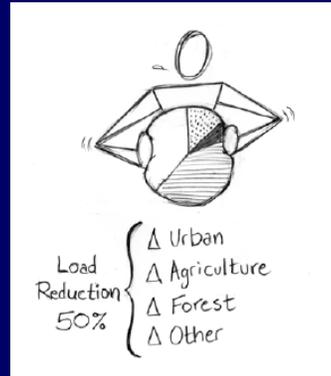
Polygon ID	Hydrological Group
9657	B
9682	B

Watershed analysis is an ongoing learning process – iterative & creative!



## Proposed management measures

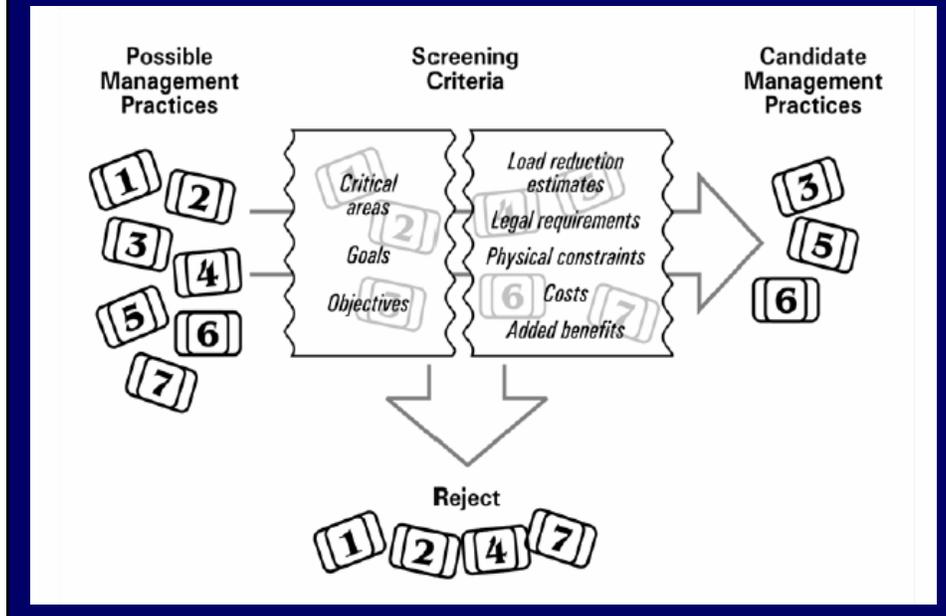
- **Pollutant reductions needed**
  - ◆ Estimate reductions desired
  - ◆ Approach selected should make sense!
- **BMP types proposed**
  - ◆ What will reduce pollutants?
  - ◆ Applicable to your situation?
- **BMP water quality benefits**
  - ◆ Can you estimate BMP impacts?
  - ◆ Use literature or actual values
- **BMP installation sites**
  - ◆ Which sites will hit the source(s)?
  - ◆ Are there critical areas to focus on?



## Examples of Different Scenarios to Meet the Same Target

Source	Existing Phosphorus Loading (kg/y)	Scenario 1		Scenario 2	
		% Load Reduction	Allowable Load (kg/y)	% Load Reduction	Allowable Load (kg/y)
Roads	78	26	58	20	62
Pasture/Hay	21	26	16	10	19
Cropland	218	26	162	55	98
Forest	97	26	72	0	97
Landfill	7	26	5	0	7
Residential	6	26	5	0	6
Groundwater	111	26	83	0	111
<b>Total</b>	<b>539</b>	<b>26</b>	<b>400</b>	<b>26</b>	<b>400</b>

## Identify candidate practices



## Select the most appropriate BMPs

- Look at what's worked and what hasn't
- Research effectiveness
- Consider costs/benefits
- Property ownership/site access
- Look for added benefits
- Use a combination of techniques
- Focus efforts on critical areas; use more or better BMPs there



# CA SWRCB Management Practice Miner

MP MINER

Management Practice Implementations Grouped by Parameter Addressed

ID	Parameter	Practice	Reference Title
135	ALKALINE/ACID PHOSPHATASE, TOTAL, WATER MIN/ML	Filter Strip	test
122	ATRAZINE IN WHOLE WATER SAMPLE US/L	Filter Strip	Pesticide Transport with Surface Runoff and Subsurface Drainage through a Vegetative Filter Strip
97	ATRAZINE IN WHOLE WATER SAMPLE US/L	Irrigation Field Ditch	Transport and fate of atrazine and lambda-cyhalothrin in an agricultural drainage ditch in the Mississippi Delta, USA
97	ATRAZINE IN WHOLE WATER SAMPLE US/L	Irrigation Field Ditch	Transport and fate of atrazine and lambda-cyhalothrin in an agricultural drainage ditch in the Mississippi Delta, USA
135	BIOTIC INDEX (SPECIES) INDEX	Filter Strip	test
49	BOD, 5 DAY, 20 DEG C MG/L	Constructed Wetland	Urban Runoff Treatment in a Fresh/Brackish Water Marsh in Fremont, California
51	BOD, 5 DAY, 20 DEG C MG/L	Constructed Wetland	Urban Runoff Treatment in a Fresh/Brackish Water Marsh in Fremont, California
50	BOD, 5 DAY, 20 DEG C MG/L	Constructed Wetland	Urban Runoff Treatment in a Fresh/Brackish Water Marsh in Fremont, California
90	CADMIUM, TOTAL (US/L AS CD)	Wet Extended Detention Pond	Storm Water Pollutant Removal by Two Wet Ponds in Bellevue, Washington
91	CADMIUM, TOTAL (US/L AS CD)	Wet Extended Detention Pond	Storm Water Pollutant Removal by Two Wet Ponds in Bellevue, Washington
92	CARBON, TOTAL ORGANIC (MG/L AS C)	Wet Extended Detention Pond	Effect of In-Lake Water Quality of Pollutant Removal in Two Ponds
93	CARBON, TOTAL ORGANIC (MG/L AS C)	Wet Extended Detention Pond	Effect of In-Lake Water Quality of Pollutant Removal in Two Ponds
25	CHLORIDE, TOTAL IN WATER MG/L	Natural Wetland Buffer	Effectiveness of a coastal wetland in reducing pollution of a Laurentian great lake: hydrology, sediment, and nutrients
98	CHLORPYRIFOS, TOTAL RECOVERABLE US/L	Cover Crop	Reducing Dormant Spray Runoff From Onbards

<http://www.swrcb.ca.gov/nps/index.html>

## Prioritizing/targeting BMPs

- Importance of waterbody
  - ◆ Drinking water source, recreational resource
- Magnitude of impairment(s)
  - ◆ Level of effort needed; public interest/attention
- Existing impacts (stressors & sources)
  - ◆ Magnitude, spatial variation, clustering
- Ability of BMPs to reduce impacts
  - ◆ Sure thing, or a shot in the dark?
- Feasibility of implementation
  - ◆ Willing partners? Public support?
- Additional benefits
  - ◆ Recreational enhancements, demonstration



# References for determining BMP effectiveness

- Stormwater/Urban (BMP Effectiveness database; Menu of BMPs)
- Agriculture (Ag Management Measure document)
- Forestry (Forestry Management Measures document)
- Mining (Development document for proposed Effluent Guideline for Mining)



[www.epa.gov/nps](http://www.epa.gov/nps)

## [www.epa.gov/owow/nps/agmm/index.html](http://www.epa.gov/owow/nps/agmm/index.html)

A screenshot of the EPA website page for National Management Measures to Control Nonpoint Source Pollution from Agriculture. The page features a navigation menu on the left, a main content area with a title and a table of contents, and a footer with a note about Adobe Acrobat Reader. The table of contents lists various chapters and sections, including an overview, management practices, and specific measures like nutrient management and erosion control.

**U.S. Environmental Protection Agency**

**Polluted Runoff (Nonpoint Source Pollution)**

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[EPA Home](#) > [Water](#) > [Wetlands, Oceans, & Watersheds](#) > [Polluted Runoff \(Nonpoint Source Pollution\)](#) > National Management Measures to Control Nonpoint Source Pollution from Agriculture

### National Management Measures to Control Nonpoint Source Pollution from Agriculture

National Management Measures to Control Nonpoint Source Pollution from Agriculture is a technical guidance and reference document for use by State, local, and tribal managers in the implementation of nonpoint source pollution management programs. It contains information on the best available, economically achievable means of reducing pollution of surface and ground water from agriculture (Final Version - July 2003).

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#### Table of Contents

- [Cover Pages](#) (PDF, 747KB, 2 pages)
- [Disclaimer, Acknowledgments, Table of Contents, List of Figures and Tables](#) (PDF, 177KB, 10 pages)
- [Chapter 1: Introduction](#) (PDF, 190KB, 8 pages)
- [Chapter 2: Overview](#) (PDF, 234KB, 22 pages)
- [Chapter 3: Management Practices](#) (PDF, 606KB, 6 pages)
- [Chapter 4: Management Measures](#)
  - [Chapter 4a: Nutrient Management](#) (PDF, 956KB, 32 pages)
  - [Chapter 4b: Pesticide Management](#) (PDF, 984KB, 20 pages)
  - [Chapter 4c: Erosion and Sediment Control](#) (PDF, 1.3MB, 18 pages)
  - [Chapter 4d: Animal Feeding Operations](#) (PDF, 1.7KB, 22 pages)
  - [Chapter 4e: Grazing Management](#) (PDF, 451KB, 26 pages)
  - [Chapter 4f: Irrigation Water Management](#) (PDF, 6.6MB, 46 pages)
- [Chapter 5: Using Management Measures to Prevent and Solve Nonpoint Source Problems in Watersheds](#) (PDF, 239KB, 12 pages)
- [Chapter 6: Monitoring and Tracking Techniques](#) (PDF, 438KB, 10 pages)
- [Chapter 7: Load Estimation Techniques](#) (PDF, 475KB, 10 pages)
- [Chapter 8: Glossary](#) (PDF, 133KB, 4 pages)
- [Chapter 9: References](#) (PDF, 293KB, 34 pages)
- [Chapter 10: Appendix](#) (PDF, 222KB, 22 pages)

You will need Adobe Acrobat Reader to view the Adobe PDF files on this page. See [EPA's PDF page](#) for more information about getting and using the free Acrobat Reader.

Table 4d-6. Relative gross effectiveness<sup>a</sup> (load reduction) of animal feeding operation control measures (Pennsylvania State University, 1992b).

Practice <sup>b</sup> Category	Runoff Volume	Total <sup>d</sup> Phosphorus (%)	Total <sup>d</sup> Nitrogen (%)	Sediment (%)	Fecal Coliform (%)
Animal Waste Systems <sup>a</sup>	reduced	90	80	60	85
Diversion Systems <sup>f</sup>	reduced	70	45	NA	NA
Filter Strips <sup>g</sup>	reduced	85	NA	60	55
Terrace System	reduced	85	55	80	NA
Containment Structures <sup>h</sup>	reduced	60	65	70	90

NA = not available.

<sup>a</sup> Actual effectiveness depends on site-specific conditions. Values are not cumulative between practice categories.

<sup>b</sup> Each category includes several specific types of practices.

<sup>d</sup> Total phosphorus includes total and dissolved phosphorus; total nitrogen includes organic-N, ammonia-N, and nitrate-N.

<sup>e</sup> Includes methods for collecting, storing, and disposing of runoff and process-generated wastewater.

<sup>f</sup> Specific practices include diversion of uncontaminated water from confinement facilities.

<sup>g</sup> Includes all practices that reduce contaminant losses using vegetative control measures.

<sup>h</sup> Includes such practices as waste storage ponds, waste storage structures, waste treatment lagoons.



### Urban Stormwater BMP Performance Monitoring

A Guidance Manual for Meeting the National  
Stormwater BMP Database Requirements

April 2002



http://www.epa.gov/owow/nps/forestrymgmt/

The screenshot shows the EPA website page for "Polluted Runoff (Nonpoint Source Pollution) from Forestry". The page features a navigation menu on the left with categories like "What is NPS Pollution", "NPS Categories", "Publications & Info Resources", "Education Resources", "Funding", "Outreach", "CWA Section 319", "CZARA Section 6217", "State EPA NPS Partnership", "Training/Meetings", and "Polluted Runoff For Kids!". The main content area includes a breadcrumb trail: "EPA Home > Water > Wetlands, Oceans, & Watersheds > Polluted Runoff (Nonpoint Source Pollution) > National Management Measures to Control Nonpoint Source Pollution from Forestry". The title is "National Management Measures to Control Nonpoint Source Pollution from Forestry". A sub-header states: "This draft guidance is intended to provide technical assistance to State, local, and tribal program managers and others on the best available, economically achievable means of reducing nonpoint source pollution of surface and ground water from forestry." Below this, there are links for "Federal Register Notice (June 27, 2001) (HTML, PDF)" and "Download full PDF version in ZIP format (13.2MB)". A "Table of Contents" section lists various documents: Introduction (89KB), Chapter 1 (568KB), Chapter 2 (1.36MB), Chapter 3 (7.68MB), Chapter 4 (73KB), Chapter 5 (61KB), Reference (78KB), Glossary (25.4KB), Appendix A (244KB), Appendix B (311KB), Appendix C (63KB), Appendix D (85KB), and Appendix E (4.2MB). A note at the bottom states: "You will need Adobe Acrobat Reader to view the Adobe PDF files on this page. See EPA's PDF page for more information about getting and using the free Acrobat Reader."

http://www.epa.gov/owow/nps/agmm/index.html

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## Sample BMP effectiveness table

Table 6-3. BMPs and removal efficiencies used in Site Evaluation Tool BMP percent efficiency

BMP	Percent Efficiency			
	TSS	Total Nitrogen	Total Phosphorus	Fecal Coliform
Wet pond	85 <sup>d</sup>	33 <sup>a</sup>	51 <sup>a</sup>	70 <sup>a</sup>
Dry detention	47 <sup>a</sup>	25 <sup>a</sup>	19 <sup>a</sup>	78 <sup>a</sup>
Stormwater wetland	76 <sup>a</sup>	30 <sup>a</sup>	49 <sup>a</sup>	78 <sup>a</sup>
Sand filter	87 <sup>a</sup>	32 <sup>a</sup>	59 <sup>a</sup>	37 <sup>a</sup>
Bioretention	87 <sup>ij</sup>	57 <sup>fg,h</sup>	76 <sup>fg,hi</sup>	90 <sup>k</sup>
Enhanced Grass swale	93 <sup>a</sup>	92 <sup>a</sup>	83 <sup>a</sup>	- 25 <sup>a</sup>
Grass swale	68 <sup>a</sup>	20 <sup>a</sup>	29 <sup>a</sup>	5 <sup>a</sup>
Infiltration trench	95 <sup>a</sup>	51 <sup>a</sup>	70 <sup>a</sup>	90 <sup>e</sup>
25-ft forest buffer	57 <sup>b,c</sup>	27 <sup>b,c</sup>	34 <sup>b,c</sup>	5 <sup>k</sup>
50-ft forest buffer	62 <sup>b,c</sup>	31 <sup>b,c</sup>	38 <sup>b,c</sup>	5 <sup>k</sup>
75-ft forest buffer	65 <sup>b,c</sup>	33 <sup>b,c</sup>	41 <sup>b,c</sup>	5 <sup>k</sup>
100-ft forest buffer	67 <sup>b,c</sup>	34 <sup>b,c</sup>	43 <sup>b,c</sup>	5 <sup>k</sup>
200-ft forest buffer	72 <sup>b,c</sup>	38 <sup>b,c</sup>	47 <sup>b,c</sup>	5 <sup>k</sup>

<sup>a</sup> Winer, R. 2000. National Pollutant Removal Performance Database for Stormwater Treatment Practices, 2nd ed. Center for Watershed Protection, Ellicott City, MD.

## EPA's Nine Elements of Plans

- a. Identify causes & sources of pollution
- b. Estimate load reductions expected from BMPs
- c. Describe mgmt measures & targeted critical areas
- d. Estimate technical and financial assistance needed
- e. Develop an education component
- f. Develop a reasonably expeditious project schedule
- g. Describe interim, measurable milestones
- h. Identify indicators to measure progress
- i. Develop a monitoring component

Source: US EPA, 2004 319 Supplemental Guidelines

## Estimate technical and financial assistance needed

- Technical assistance
  - ◆ Volunteer and other monitoring
  - ◆ Outreach and education support
  - ◆ Design/engineering assistance
- Financial assistance
  - ◆ Money
  - ◆ Cash
  - ◆ Dinero
  - ◆ Moolah

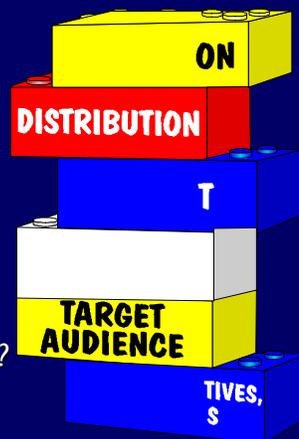


## Develop an education component

“An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the NPS management measures that will be implemented.”

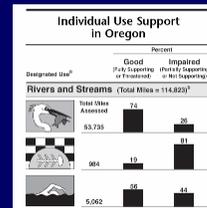
*What stage of outreach or education are we at?*

- Awareness
- Education
- Action



## Developing info/ed activities

- Define overall goal and objectives
- Identify and characterize target audience
- Create message(s) for target audience(s)
- Package the messages for distribution
- Distribute messages to the audiences
- Evaluate the information/education effort



## Develop a reasonably expeditious project schedule



- Who's going to do something?
- What are they going to do?
- Where will they do it?
- When will they do it?
- How will they do it?
- Lots of detail for the short term
- Less detail for long-term projects

## Describe interim, measurable milestones

“A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.”



## Identify indicators to measure progress

“A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether this watershed-based plan needs to be revised or, if a NPS TMDL has been established, whether the NPS TMDL needs to be revised



## Develop a monitoring component

“A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (h) immediately above.”

